

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellants: Hans Lobl et al.

Group Art Unit: 2811

Application No.: 10/527,115

Examiner: Nadav, Ori

Filed: March 8, 2005

Confirmation No.: 9528

For: BULK ACOUSTIC WAVE RESONATOR WITH MEANS
FOR SUPPRESSION OF PASS-BAND RIPPLE IN BULK
ACOUSTIC WAVE FILTERS

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REPLY BRIEF UNDER 37 C.F.R. § 41.41(a)

This is an appeal to the Board of Patent Appeals and Interferences from the decision of the Examiner dated November 25, 2009, which finally rejected claims 7-10 and 15-24 in the above-identified application. An Appeal Brief was filed on April 26, 2010. This Reply Brief is in response to Examiner's Answer dated June 11, 2010. This Reply Brief is hereby submitted pursuant to 37 C.F.R. § 41.41(a).

CERTIFICATE OF MAILING UNDER 37 C.F.R. 1.8

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I. STATUS OF CLAIMS

Claims 1-5 are canceled.

Claims 6, 11-14, and 25 are withdrawn. Specifically, claims 6 and 13 were withdrawn by Appellants in the response mailed June 6, 2008, and claims 11, 12, 14, and 25 were withdrawn by Appellants in the response mailed January 25, 2010.

No claims are objected to.

Claims 7-10 and 15-24 stand rejected as follows:

Claims 7, 8, and 16 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Nishihara et al. (U.S. Pat. No. 6,734,763, hereinafter Nishihara).

Claims 7, 8, and 16-24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishihara.

Claims 9, 10, and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishihara in view of Kobrin et al. (U.S. Pat. No. 5,936,150, hereinafter Kobrin).

Claims 7-10 and 15-24 are the subject of this appeal. A copy of the claims is set forth in the Claims Appendix.

II. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

- A. Whether claims 7, 8, and 16 are patentable over Nishihara under 35 U.S.C. § 102(e).
- B. Whether claims 7, 8, and 16-24 are patentable over Nishihara under 35 U.S.C. § 103(a).
- C. Whether claims 9, 10, and 15 are patentable over Nishihara and Kobrin under 35 U.S.C. § 103(a).

III. ARGUMENT

For the purposes of this appeal, claims 7, 8, and 16 are argued together as a group for purposes of the question of patentability over Nishihara under 35 U.S.C. § 102(e). Claims 7, 8, and 16-24 are argued together as a separate group for purposes of the question of patentability over Nishihara under 35 U.S.C. § 103(a). Claims 9, 10, and 15

are argued as a separate group for purposes of the question of patentability over Nishihara in view of Kobrin under 35 U.S.C. § 103(a).

A. Claims 7, 8, and 16 are patentable over Nishihara because Nishihara does not disclose all the limitations of the claims.

Appellants respectfully submit that claims 7, 8, and 16 are patentable over Nishihara because Nishihara does not disclose all of the limitations of the claims. Specifically, claim 7 recites:

A bulk acoustic wave (BAW) resonator comprising:

a top electrode;

a piezoelectric layer disposed adjacent to the top electrode;

a bottom electrode disposed adjacent to the piezoelectric layer, wherein the bottom electrode is disposed opposite the top electrode relative to the piezoelectric layer; and

a substrate disposed opposite the piezoelectric layer relative to the bottom electrode, wherein the substrate comprises an uneven surface to suppress a spurious mode, wherein the uneven surface is on a rear side of the substrate facing away from the bottom electrode.

(Emphasis added.)

Appellants respectfully maintain the arguments made in previous actions and herein provide further support that claim 7 is patentable over Nishihara under 35 U.S.C. § 102(e). Specifically, Appellants submit that Nishihara does not disclose an uneven surface on a rear side of the substrate facing away from the bottom electrode. In response to the previous arguments made by Appellants, the Examiner admits that Nishihara does not explicitly state which surface of the substrate has a surface roughness. Examiner's Answer, page 10. However, the Examiner infers that because Nishihara does not disclose a surface of the substrate having a surface roughness, the entire block of the substrate of Nishihara purportedly has a surface roughness. Examiner's Answer, page 10. Furthermore, the Examiner asserts that, because the entire substrate of Nishihara purportedly has a surface roughness, purportedly all surfaces of the substrate must inherently suppress a spurious mode of the resonator. Examiner's Answer, page 12. Additionally, the Examiner assumes that if a surface is not disclosed as cleaned and polished then the surface is purportedly rough enough to suppress a spurious mode and

anticipate the limitations of claim 7. Examiner's Answer, page 14. Nevertheless, the reasoning asserted by the Examiner is not proper.

In an attempt to support the rejection of claim 7 under 35 U.S.C. § 102(e), the Examiner uses flawed logic regarding the several points mentioned above. Appellants submit that, not only does Nishihara not explicitly state which surface of the substrate has a surface roughness, Nishihara does not disclose an uneven surface to suppress a spurious mode, wherein the uneven surface is on a rear side of the substrate. In order to establish a rejection under 35 U.S.C. § 102(e), the cited reference must have specific description of the limitations of the claims. Here, the Examiner does not provide evidence of explicit disclosure but simply infers that because Nishihara does not disclose a specific surface with a roughness to suppress a spurious mode, all of the surfaces of Nishihara purportedly have a roughness and that any natural surface roughness is purportedly inherently capable of suppressing a spurious mode.

The Examiner appears to recognize the lack of explicit disclosure by Nishihara because the Examiner asserts that it is allegedly inherent in Nishihara that any surface quality other than polished and cleaned would suppress a spurious mode. However, this assertion is insufficient to support the rejection of claim 7 at least because the assertion of inherency is not properly supported by rationale or evidence, as required by the MPEP.

The MPEP states that the Examiner must provide rationale or evidence in order to show inherency. MPEP 2112(IV). More specifically, in relying on a theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the assertion that an allegedly inherent characteristic necessarily flows from the teachings of the cited reference. Id. Moreover, the MPEP states that the possible occurrence of a result or characteristic is not sufficient to establish inherency of the asserted result or characteristic. Id.

However, in light of the lack of disclosure by Nishihara of an uneven surface to suppress a spurious mode, the Examiner simply concludes that it is allegedly inherent that a rough surface would suppress a spurious mode. The conclusion of inherency asserted by the Examiner is not supported by any rationale or evidence. Although the Examiner concludes that suppression of a spurious mode by a rough surface is allegedly inherent, the Office Action does not attempt to provide any rationale to explain why this effect

might have been inherent. More specifically, the Examiner does not attempt to explain how the lack of disclosure of polishing and cleaning a surface results in no surface being cleaned and polished and that a surface that has not been cleaned and polished is capable of suppressing a spurious mode, generally, might lead to the asserted conclusion of inherency. Additionally, the Examiner does not describe any facts or technical reasoning that would support the assertion of inherency. Moreover, the Examiner does not provide any extrinsic evidence to remedy this lack of rationale. In other words, the Examiner asserts the unsupported conclusion of inherency, without providing any rationale or evidence to show how the Examiner might have arrived at the asserted conclusion of inherency.

For example, although the invention is limited only by the scope of the claims, it may be helpful to understand that the description in the current application describes that the substrate may be roughened by etching, blasting, or some other additional step in order to provide the roughness to scatter the standing wave in a spurious mode. Detailed Description, page 4, lines 21-24. Therefore, Appellants assert that it is illogical to infer that the surfaces of the cited device may be unpolished, and that, even if the surfaces of the substrate were hypothetically unpolished, how the purportedly unpolished surfaces of Nishihara, Fig. 21 would be capable of suppressing a spurious mode when Nishihara does not address a spurious mode or suppression of a spurious mode.

Therefore, Appellants maintain that a failure to disclose the surface roughness on the substrate amounts to a failure to disclose the surface roughness to suppress a spurious mode on a rear side of the substrate facing away from the bottom electrode. Accordingly, Appellants respectfully submit that claim 7 is patentable over Nishihara under 35 U.S.C. § 102(e) because Nishihara does not disclose an uneven surface to suppress a spurious mode, wherein the uneven surface is on a rear side of the substrate facing away from the bottom electrode.

As a note, it appears from the statement made by the Examiner (Examiner's Answer, page 13), that the Examiner still disagrees with the language of the claim used to define the relative location of the uneven surface. However, Appellants reaffirm the previously presented arguments regarding the language of the claims.

Given that each of claims 8 and 16 depends from and incorporates all of the limitations of independent claim 7, Appellants respectfully submits that claims 8 and 16 are patentable over Nishihara for depending from an allowable base claim. Additionally, each of claims 8 and 16 may be allowable for further reasons.

B. Claims 7, 8, and 16-24 are patentable over Nishihara because it would not have been obvious to modify Nishihara to include an uneven surface.

Appellants respectfully submit that claims 7, 8, and 16-24 are patentable over Nishihara because it would not have been obvious to modify Nishihara to include the missing limitations of the claims

The Examiner does not provide reasoning to show how it would be obvious to modify the device of Nishihara to include an uneven side on the side of the substrate that faces away from the bottom electrode. Additionally, it appears that the Examiner suggests that it would be obvious to modify the device of Nishihara to have a surface roughness sufficient to suppress a spurious mode. However, Appellants submit that it would not be obvious to modify the device of Nishihara in the suggested manners for at least two reasons.

First, the Examiner has not established a *prima facie* case of obviousness to support the suggestion to modify Nishihara to include an uneven surface on the side of the substrate that faces away from the bottom electrode. The Examiner simply assumes, without providing support, that Nishihara teaches an uneven surface on some side of the substrate and that it would purportedly be obvious to modify Nishihara to have the uneven side on the side of the substrate that faces away from the bottom electrode. Appellants submit that Nishihara does not teach an uneven surface on the side of the substrate that faces away from the bottom electrode at least for similar reasons to those presented above with regard to the rejection of claim 7 under 102(e). It appears that the Examiner relies on a portion of Nishihara as purportedly teaching an uneven surface. However, the cited portion (Nishihara, col. 3, lines 4-11) simply states that the sacrificial layer has a greater surface roughness than that of the silicon substrate. This statement does not teach an uneven surface on the substrate. Specifically, the substrate has a polished surface and the sacrificial layer has a surface that is relatively more rough than

the substrate. Nishihara teaches that the surface of the substrate which forms the cavity is polished. Nishihara, col. 3, lines 12-33. Therefore, there is no support for the assumption of the Examiner that there is an uneven surface on the substrate in the device of Nishihara.

Second, the Examiner suggests that modifying Nishihara to have a rough surface on the side of the substrate that faces away from the bottom electrode substrate would improve adhesion. However, the Examiner refers to the adhesion onto the opposite side of the substrate. Appellants submit that the suggested modification is unrelated to the reasoning offered in support of the modification.

Therefore, it would not have been obvious to modify the teachings of Nishihara based on the reasons asserted by the Examiner because there is no support for inclusion of an uneven surface and modifying the device of Nishihara would not achieve the stated objective of improving adhesion, but rather would reduce the indicated adhesion. Accordingly, Appellants respectfully submit that claim 7 is patentable over Nishihara under 35 U.S.C. § 103(a) because the Examiner does not establish a *prima facie* case of obviousness.

Appellants respectfully assert independent claim 20 is also patentable over Nishihara at least for similar reasons to those stated above in regard to the rejection of independent claim 1. In particular, the rejection of claim 20 merely relies on the same reasoning that the Examiner provided for the rejection of claim 1. Here, although the language of claim 20 differs from the language of claim 1, and scope of each claim should be interpreted independently of other claims, Appellants respectfully assert that the remarks provided above in regard to the rejection of claim 1 also apply to the rejection of claim 20. Accordingly, Appellants respectfully assert independent claim 20 is patentable over Nishihara because it would not have been obvious to modify Nishihara.

Given that claims 8, 16-19, and 21-24 depends from and incorporates all of the limitations of the corresponding independent claims 7 and 20, Appellants respectfully submits that claims 8, 16-19, and 21-24 are patentable over Nishihara for depending from an allowable base claim. Additionally, each of claims 8, 16-19, and 21-24 may be allowable for further reasons.

C. Claims 9, 10, and 11 are patentable over Nishihara and Kobrin because the combination of cited references does not teach all of the limitations of the claims.

Appellant respectfully submits that claims 9, 10, and 11 are patentable over Nishihara and Kobrin because each of claims 9, 10, and 11 depends from and incorporates all of the limitations of independent claim 7. Additionally, each of claims 9, 10, and 11 may be allowable for further reasons.

IV. CONCLUSION

For the reasons stated above, claims 7-10 and 15-24 are patentable over the cited references. Thus, the rejections of claims 7-10 and 15-24 should be withdrawn.

Appellant respectfully requests that the Board reverse the rejections of claims 7-10 and 15-24 under 35 U.S.C. §§ 102(e) and 103(a).

At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account **50-4019** pursuant to 37 C.F.R. 1.25. Additionally, please charge any fees to Deposit Account **50-4019** under 37 C.F.R. 1.16, 1.17, 1.19, 1.20 and 1.21.

Respectfully submitted,

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V. CLAIMS APPENDIX

1-5. (canceled)

6. (withdrawn) Method for manufacturing a bulk acoustic wave resonator comprising the steps of

providing a holder in the form of a silicon chip or dice,
disposing a top electrode on the silicon dice,
disposing a piezoelectric layer,
disposing a bottom electrode,
disposing a Bragg reflector,
disposing a front side absorbing layer,
disposing a substrate, and
removing the holder.

7. A bulk acoustic wave (BAW) resonator comprising:

a top electrode;
a piezoelectric layer disposed adjacent to the top electrode;
a bottom electrode disposed adjacent to the piezoelectric layer, wherein the bottom electrode is disposed opposite the top electrode relative to the piezoelectric layer; and
a substrate disposed opposite the piezoelectric layer relative to the bottom electrode, wherein the substrate comprises an uneven surface to suppress a spurious mode, wherein the uneven surface is on a rear side of the substrate facing away from the bottom electrode.

8. The BAW resonator of claim 7, wherein the uneven surface of the substrate comprises a roughened surface to scatter the spurious mode.

9. The BAW resonator of claim 8, wherein the roughened surface of the substrate comprises an etched surface of glass.

10. The BAW resonator of claim 8, wherein the roughened surface of the substrate comprises a blasted layer of glass.
11. (withdrawn) The BAW resonator of claim 7, further comprising an absorbing layer disposed on the substrate to absorb the spurious mode.
12. (withdrawn) The BAW resonator of claim 11, wherein the absorbing layer is disposed on a front side of the substrate, between the substrate and the bottom electrode.
13. (withdrawn) The BAW resonator of claim 11, wherein the absorbing layer is disposed on the rear side of the substrate, opposite the bottom electrode relative to the substrate.
14. (withdrawn) The BAW resonator of claim 11, wherein the absorbing layer comprises at least one acoustic absorbing material of a plurality of acoustic absorbing materials, wherein the plurality of acoustic absorbing materials comprises epoxy glue, an elasticoviscous material, rubber, silicon rubber, a plastic material, a porous media, and a porous thin film.
15. The BAW resonator of claim 7, further comprising a Bragg reflector disposed between the substrate and the bottom electrode.
16. The BAW resonator of claim 7, wherein:
 - the top electrode comprises a first metal material;
 - the piezoelectric layer comprises at least one of a plurality of piezoelectric material; and
 - the bottom electrode comprises a second metal material.
17. The BAW resonator of claim 16, wherein the first metal material of the top electrode comprises aluminum (Al).

18. The BAW resonator of claim 16, wherein the plurality of piezoelectric materials comprises aluminum nitride (AlN), zinc oxide (ZnO), and lead zirconate titanate (PZT).
19. The BAW resonator of claim 16, wherein the second metal material of the bottom of electrode comprises molybdenum (Mo), platinum (Pt), or tungsten (W).
20. A bulk acoustic wave (BAW) filter comprising:
 - a first BAW resonator to suppress a pass-band ripple of a spurious mode; and
 - a second BAW resonator connected to the first BAW resonator, the second BAW resonator to suppress the pass-band ripple of a spurious mode;

wherein each of the first and second BAW resonators comprises a substrate with an uneven surface to suppress a spurious mode, wherein the uneven surface is on a rear side of the substrate facing away from the first and second BAW resonators.
21. The BAW filter of claim 20, wherein the first and second BAW resonators are connected in a ladder configuration.
22. The BAW filter of claim 20, wherein the first and second BAW resonators are connected in a lattice configuration.
23. The BAW filter of claim 20, wherein each of the first and second BAW resonators comprises:
 - a top electrode;
 - a piezoelectric layer disposed adjacent to the top electrode; and
 - a bottom electrode disposed adjacent to the piezoelectric layer, wherein the bottom electrode is disposed opposite the top electrode relative to the piezoelectric layer;

wherein the substrate is disposed opposite the piezoelectric layer relative to the bottom electrode.
24. The BAW filter of claim 20, wherein the uneven surface of the substrate comprises a roughened surface to scatter the spurious mode.

25. (withdrawn) The BAW filter of claim 20, further comprising an absorbing layer disposed on the uneven surface of the substrate to absorb the spurious mode.